QUALITY ASSURANCE PROJECT PLAN FOR SAMPLING PATHOGEN-INDICATORS IN THE COACHELLA VALLEY STORM WATER CHANNEL

Prepared by and for:

California Regional Water Quality Control Board
Colorado River Basin Region

SEPTEMBER 27, 2002

QUALITY ASSURANCE PROJECT PLAN
FOR SAMPLING PATHOGEN-INDICATORS IN THE
COACHELLA VALLEY STORM WATER CHANNEL

APPROVALS:

_____	_____
Jose Angel, P.E., Supervising WRC Engineer, Project Supervisor, Quality Assurance Officer, Watershed Protection Division Chief	Date
_____	_____
Teresa Gonzales, Senior Environmental Scientist, Project Manager, TMDL Development Unit Chief	Date

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APPENDICES

1 PROJECT MANAGEMENT

This Quality Assurance Project Plan (QAPP) describes sampling and quality assurance (QA) activities to be undertaken by the Regional Water Quality Control Board, Colorado River Basin Region (Regional Board) to characterize pathogen pollution in the Coachella Valley Storm Water Channel (CVSWC). The Regional Board seeks to characterize pathogen pollution in the Coachella Storm Water Channel by sampling for pathogen-indicator organisms (i.e., bacteria) and by potentially including other constituents (i.e., ammonia, nitrate, total organic carbon, caffeine) that are typically associated with specific sources of pollution.

This QAPP follows the format that the United States Environmental Protection Agency (USEPA) established in its *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, March 2001*. Further, this QAPP also complies with Quality Assurance/Quality Control (QA/QC) procedures of the State Water Resources Control Board's Quality Assurance Project Plan (State Water Resources Control Board 1994). This QAPP addresses the fundamental QA activities to be undertaken in sampling the aforementioned surface waters. To the degree necessary, more specific sampling activities (e.g., sampling stations not identified herein) will be addressed by staff through separate documentation (e.g., memoranda) that will be part of the project file for sampling activities, as described in the following paragraphs.

1.1 DISTRIBUTION LIST

The following individuals will receive copies of the approved QAPP and subsequent revisions:

Jose Angel, P.E., Division Chief*
Teresa Gonzales, Project Manager, TMDL Development Unit Chief*
Ivory Reyburn, Environmental Scientist, Lead Field Sampler

*Indicates approving authority

Copies of the approved QAPP and subsequent revisions will be placed in the following Regional Board file:

- TMDL QAQC (TMDL Section Quality Assurance File)

1.2 TASK ORGANIZATION

Specific responsibilities of Regional Board staff are outlined below. A project organization chart is provided as Appendix A.

Jose L. Angel, P.E., Division Chief, Quality Assurance Officer, 760-776-8932.

- Reviews and approves the QAPP and subsequent revisions.
- Ensures that the QAPP is implemented to meet project objectives.
- Coordinates Regional Board Laboratory operation and quality assurance activities.
- Reviews and approves the QAPP and subsequent revisions.
- Ensures that the QAPP is implemented to meet project objectives.
- Performs and documents validation activities for field and laboratory data.

Teresa Gonzales, Project Manager, Senior Environmental Scientist, TMDL Dev. Unit Chief, 760-776-8931.

- Reviews and approves the QAPP and subsequent revisions.
- Ensures that the QAPP is implemented to meet project objectives.
- Ensures that field personnel have appropriate training and certification for field activities.
- Reviews field reports.
- Ensures plans are implemented according to schedule.
- Ensures that sample containers have no defects and have been prepared properly.

- Prepares quarterly reports.
- Manages sampling data.
- Performs field sampling as necessary.
- Conducts Health and Safety briefing for field samplers prior to each sampling event.
- Coordinates field and laboratory activities.
- Gives accounts of project status to the Division Chief.
- Reviews data and spreadsheet programs while the project is on-going.
- Prepares a final report.

Ivory Reyburn, Lead Field Sampler, Environmental Scientist, (760) 776-8933
- Coordinates field activities and ensures they are consistent with the QAPP.
- Conducts assignment briefing for field samplers prior to each sampling event.
- Conducts sampling activities as necessary**.**
- Maintains and calibrates instruments in the field.
- Prepares a summary report for each sampling event.
- Coordinates delivery of samples to the laboratory.
- Coordinates decontamination of equipment including sample containers and vehicles potentially subject to contamination.

Phan Le, Deputy Lab Director, WRC Engineer, (760) 346-7491.
- Calibrates equipment prior to sampling events.
- Assists Regional Board laboratory with water quality analyses as necessary.
- Assists with sampling activities as necessary.

Jeff Allred, Field Sampler, WRC Engineer, (760) 776-8946.
- Assists with sampling activities as necessary.

Theresa Illare, Field Sampler, Environmental Scientist, (760) 776-8971.
- Assists with sampling activities as necessary.

Nadim Zeywar, Ph.D., Field Sampler, Environmental Scientist, (760) 776-8971.
- Assists with sampling activities as necessary.

Sheila Ault, Field Sampler, Environmental Scientist, (760) 776-8960.
- Assists with sampling activities as necessary.

Jason Voskanian, Field Sampler, SETT, (760) 776-8930.
- Assists with sampling activities as necessary.

1.3 DOCUMENTATION

1.3.1 PROJECT WORKING FILE

The Project Manager will establish and maintain a separate CVSWC Project Working File for filing sampling records. The Lead Field Sampler and QA Officer will ensure that all received/generated data (e.g., field notes, chain-of-custody forms, lab analyses) are delivered to the Project Manager. The Project Working File will be available for review by the QA Officer and TMDL Development Unit Chief. The file will contain, but need not be limited to:

- Field notebooks
- Calibration logs

- Laboratory reports
- Data reports summarizing field activity and quality control for each sampling event
- Data spreadsheets
- Correspondence
- Quality control reports
- Validation reports
- Copies of historic data
- Final report

1.3.2 FIELD LOG NOTEBOOK AND FIELD DATASHEETS

The Lead Field Sampler will use a Field Log Notebook to document field activities and data for each sampling event. This notebook will have pre-numbered pages. Each page of the Field Log Notebook and field datasheets will be dated and signed by a sampling team member at each sampling station. At the time of sampling, the following information will be recorded in the Field Log Notebook:

- Weather observations
- Sampling station latitude and longitude, using a global positioning system (GPS) unit
- Sample identification code and sampling method for all samples taken
- Readings for temperature, pH, dissolved oxygen (DO), and electrical conductivity (EC)
- Sample identification code, and time and location of preparation, for all quality control samples prepared in the field
- Any deviations from the QAPP
- Any noteworthy observations

1.3.3 SAMPLING EVENT SUMMARY REPORT

The Lead Field Sampler will prepare a Sampling Event Summary Report for each sampling event, for the Project Manager. The reports will be due to the Project Manager within 7 days following each sampling event. The reports will summarize:

- Sampling plan
- Team briefings
- Equipment calibration
- Equipment decontamination
- Any deviations from the QAPP
- Any problems encountered and how the problems were addressed
- Recommendations as appropriate

1.3.4 QUALITY CONTROL LOG NOTEBOOK

The QA Officer will use a Quality Control Log Notebook to document the quality control (QC) samples submitted to the laboratory and the analysis results. The Quality Control Log Notebook will be bound and will have pre-numbered pages. For each QC sample, the Quality Control Log Notebook will contain the:

- Sample identification code
- Supplier of the QC sample
- Value reported by the supplier
- Date of preparation and submission
- Name and signature of the person submitting the QC sample

- Laboratory performing the analysis
- Analysis method
- Reported value from the laboratory

Regional Board laboratory personnel will maintain the original Quality Control Log Notebook.

1.3.5 CALIBRATION LOG NOTEBOOK

The Deputy Lab Director will use a Calibration Log Notebook to document calibration activities performed on sampling equipment prior to each sampling event. The Calibration Log Notebook will be bound and will have pre-numbered pages. For each calibration event, the Calibration Log Notebook will contain:

- The date and time of calibration
- The persons performing the calibration
- The signature of one of the persons performing the calibration
- All standard solutions used in calibration, including the source and date of preparation of the standard solution
- The initial reading of the YSI 6600 multiprobe sonde when tested against each standard solution, and the temperature of each standard solution at the time of calibration
- Any deviations from the QAPP
- Any problems encountered and how the problems were addressed

Regional Board laboratory personnel will maintain the original Calibration Log Notebook.

1.3.6 LABORATORY ANALYTICAL SUMMARIES

The Project Manager will request that the laboratory conducting the analyses prepare and submit, to the Project Manager, a Laboratory Analytical Summary for each sampling event upon completion of the laboratory's analysis of samples. This summary will include analytical results and copies of the appropriate chain-of-custody forms. The summary must include:

- The lab Sample ID
- The Regional Board Sample ID
- Matrix type
- Name of person who collected the sample
- Date and time sample was collected
- Date and time sample was received by the lab
- Date and time lab analyzed sample
- The analysis results
- The RDL, units, and analytical method
- The name of the analyst

The summary should also include any noteworthy observations regarding the integrity of samples received and the results.

1.3.7 QUALITY ASSURANCE REPORTS

The Quality Assurance Officer will prepare quality assurance reports, including a Technical Systems Audit for each sampling event, Performance Evaluations of laboratories, a final Audit of Data Quality, and a Data Quality Assessment. These reports are described in more detail in Section 7.

1.3.8 QUARTERLY REPORTS

The Project Manager will prepare Quarterly Reports for the Division Chief. These reports will include:

(1) quantitative and qualitative analyses of field and laboratory data
(2) a discussion of data quality
(3) recommendations for QAPP modification if necessary

1.3.9 FINAL REPORT

The Project Manager will prepare a final report, which will include:

- quarterly report data
- summary of activities
- discussion of data and its quality
- problems encountered and their solutions
- samples that violate Water Quality Standards

2 PROJECT DESCRIPTION

The Region's 303(d) list identifies the CVSWC as water quality limited because pathogen concentrations violate Water Quality Standards (WQS) established by the Regional Board to protect beneficial uses. Pursuant to Section 303(d) of the Clean Water Act (CWA), the Regional Board is developing a CVSWC Pathogen TMDL. TMDL development requires a Source Analysis that: (a) identifies the sources of the pollutant of concern, and (b) quantifies their relative contributions. Data collection activities outlined in this QAPP are being undertaken in support of TMDL development.

2.1 PROJECT AREA

2.1.1 COACHELLA VALLEY

The Coachella Valley Storm Water Channel is located in the Coachella Valley of central Riverside County in Southern California. It originates where the Whitewater River Stormwater Channel becomes the Coachella Valley Storm Water Channel east of Washington Street in the city of La Quinta. The unlined, earthen channel flows approximately 17 miles to the southeast through municipal and agricultural areas and ultimately outlets to the Salton Sea. The CVSWC serves as a drainage way for agriculture return water, treated domestic wastewater, and storm water runoff. The agricultural return flows consist mostly of subsurface drainage (tilewater), which mixes with groundwater seepage. Agricultural return flows represent the majority of the flows entering the Salton Sea because seasonal flows and effluents are minor (Montgomery 1989).

3 SAMPLING DESIGN

This project is designed to measure four pathogen-indicator constituents and four field parameters at each sampling station. Samples for the pathogen indicators will be collected as specified in Section 4.2 . Laboratory analyses of collected samples will be conducted in accordance with USEPA approved methods.

The initial phase of this project consists of a minimum of six monthly sampling events. During each sampling event, samples will be collected and field measurements taken at pre-selected sampling stations if conditions are favorable for site access. The first event is scheduled for October 2002.

The Project Manager will ensure that field personnel have current training for sampling and handling activities as required by OSHA regulations.

3.1 PROJECT OBJECTIVE

The overall project objective is to obtain data of known quality for use in: (a) the proposed CVSWC Pathogen TMDL and (b) baseline comparisons, in which changes can be evaluated between baseline pathogen-indicator levels and future levels. Specific objectives are to:

1. Collect representative water samples for pathogen-indicator organisms (fecal coliform, *E. coli*, fecal streptococci, fecal enterococci) for lab analysis and/or DNA fingerprinting analysis.
2. Record field measurements (physical parameters) of temperature, pH, dissolved oxygen (DO), and electrical conductivity (EC).
3. Evaluate data to identify and quantify sources of pathogens.

3.2 SELECTED CONSTITUENTS AND FIELD MEASUREMENTS

To accomplish the project objectives, constituents to be sampled include pathogen-indicator organisms (i.e., fecal coliform, *E. coli*, fecal streptococci, fecal enterococci) and when deemed necessary, ammonia, nitrate, total organic carbon, and caffeine. Field measurements to be taken include temperature, pH, dissolved oxygen, and electrical conductivity. Table 2 presents the constituents and field measurements, along with their corresponding action levels, units of measure, and analytical methods.

Table 2: Analytical Methods for Constituents and Field Measurements

	Action Level*	Unit of Measure	Method
Constituent			
Fecal Coliform	200	MPN/100 mL	Standard Method 9221E
E. coli	126	MPN/100 mL	Standard Method 9221F
Fecal Streptococci	Not applicable	MPN/100 mL	Standard Method 9230B
Fecal Enterococci	33	MPN/100 mL	Standard Method 9230B
Ammonia	See Appendix B	mg/L	USEPA 350.1
Nitrate	Not applicable	mg/L	USEPA 300.0
Total Organic Carbon (TOC)	Not applicable	mg/L	USEPA

Caffeine	Not applicable	mg/L	AOAC 17th Ed. 979.11 HPLC
Field Measurement			
Temperature	Not applicable	°C	YSI 6600 multiprobe sonde
pH	<6.0 or >9.0	pH Units	YSI 6600 multiprobe sonde
Dissolved Oxygen (DO)	<5.0	mg/L	YSI 6600 multiprobe sonde
Electrical Conductivity (EC)	Not applicable	μmhos/cm	YSI 6600 multiprobe sonde

* The Basin Plan establishes a narrative water quality objective for toxicants (e.g.. ammonia), as well as a numeric water quality objective for nitrate of 45 mg/l for sources of drinking water (e.g., the Colorado River). These water quality objectives are identified herein as action levels (i.e., decision threshold values for the constituents of concern). These action levels represent the value of concern, where an action by the Regional Board will be required. Appendix B shows the concentrations at which ammonia can be toxic to aquatic life.

The selected pathogen-indicator organisms are especially important because the Basin Plan specifies Water Quality Standards in terms of quantified *E. coli*, fecal coliform, and fecal enterococci levels. These are discussed in more detail in the following three paragraphs.

E. coli is a type of fecal coliform, which is a subgroup of total coliform bacteria. Total coliform bacteria are found in human and animal feces and in soil. Therefore, they may not necessarily be pathogenic because of their presence in soil. However, fecal coliform (a type of total coliform) is specifically associated with the feces of humans and other warm-blooded animals, and may pose a significant threat to public health. They also are more representative of the sanitary quality of surface waters than are total coliform organisms. Therefore, fecal coliform is a more important measure than is total coliform for the purposes of this study.

Fecal enterococci (the other pathogen-indicator quantified in the Basin Plan) is a subgroup of fecal streptococci. Fecal streptococci, like fecal coliform, are associated with human wastes. Therefore, fecal streptococci and fecal coliform (and associated subgroups) were selected specifically as indicators of human pathogen presence that pose a threat to public health.

Other constituents may also help determine the source and amounts of pollutants. Ammonia and nitrate analyses could help verify to what degree septic tank discharges are degrading water quality. TOC analyses could help determine the amount of organic pollutants (including pesticides) present in the water column, and may help ascertain bacteria growth potential. Acute caffeine analyses might help determine if the bacteria are of human origin.

Field measurement parameters will help establish baseline conditions in waters at the time of sampling.

3.3 DATA QUALITY OBJECTIVES

Valid data of known quality are needed to meet the project objective. Therefore, data will be considered valid only if data quality objectives are met. Specific data quality objectives of this project include:

1. Laboratory analyses for pathogen-indicator organisms (i.e., fecal coliform, *E. coli*, fecal streptococci, fecal enterococci) must be of sufficient quality to be used in the Source Analysis of the pathogen TMDL. Therefore, samples collected should be of sufficient quality to be used for laboratory analyses including DNA fingerprinting analysis, in order to determine relative pathogen contributions from various sources.
2. Laboratory analyses for indicators must be of sufficient quality to be used in the determination of baseline pathogen conditions in the system. Therefore, samples collected must be of sufficient quality to be used for

laboratory analyses, in order to determine relative changes in pathogen-indicator concentrations/densities over time, as land use practices and/or hydrological and/or climate conditions change.

3. Laboratory analyses of any other constituents (e.g., ammonia, nitrate, total organic carbon, caffeine) must be of sufficient quality to be used in the Source Analysis of the pathogen TMDL and in the determination of baseline conditions in the system. Therefore, samples collected should be of sufficient quality to be used for laboratory analyses.
4. Field measurements (i.e., temperature, pH, dissolved oxygen, electrical conductivity) must be of sufficient quality to be used in analyses for TMDL development and baseline comparisons.

Data quality objectives for all constituents and field measurements are listed in Table 1.

Tabl: Data Quality Objectives For All Constituents and Field Measurements

	Matrix	Units	Reporting Limit	Precision (RPD)	Accuracy (% Recovery)	Completeness (% C)
Constituent						
Fecal Coliform	Water	MPN/100 mL	2	Must fall within 95% confidence interval[1]	Not applicable	95
E. coli	Water	MPN/100 mL	2	Must fall within 95% confidence interval[1]	Not applicable	95
Fecal Streptococci	Water	MPN/100 mL	2	Must fall within 95% confidence interval[1]	Not applicable	95
Fecal Enterococci	Water	MPN/100 mL	2	Must fall within 95% confidence interval[1]	Not applicable	95
Ammonia	Water	mg/L	0.2	20	80-120	95
Nitrate	Water	mg/L	0.2	20	80-120	95
Matrix Spike - Ammonia	Water	mg/L	0.2	20	75-125	Not applicable[2]
Matrix Spike - Nitrate	Water	mg/L	0.2	20	75-125	Not applicable[2]
Total Organic Carbon (TOC)	Water	mg/L	0.8	20	Not applicable	95
Caffeine	Water	µg/L	1	20	Not applicable	95
Field Measurement						
Temperature	Water	°C	0.01	Not applicable	Not applicable	95
pH	Water	pH units	0.01	Not applicable	Not applicable	95
Dissolved Oxygen (DO)	Water	mg/L	0.1% air saturation	Not applicable	0-200% air saturation: ± 2% of reading or 2% of air saturation (whichever is greater). 200-500% air saturation: ± 6% of reading	95
Electrical Conductivity (EC)	Water	µmhos/cm	0.001 mS/cm	Not applicable	± 0.5% + 0.001 mS/cm	95

[1] Listed in Table 9221.IV of Clesceri et. al 1995
[2] Will not be applied to quality control samples

3.4 DATA QUALITY INDICATORS

Data will be considered valid only if data quality indicators show that the data quality objectives were met. Data quality indicators for this project include precision, accuracy, % completeness, and representativeness. Each of these is described below.

3.4.1 PRECISION

Precision is defined as the degree of refinement of a measurement. Precision will be assessed as the relative percent difference (RPD) for laboratory duplicate samples and field duplicates. The following equation will be used:

$$RPD = \frac{(C1 - C2)*100}{\left(\frac{C1 + C2}{2}\right)}$$

RPD = relative percent difference
C_1 = larger of the reported value or measurement
C_2 = smaller of the reported value or measurement

3.4.2 ACCURACY

Accuracy is defined as the degree of conformity of a measurement to the actual value or standard. Accuracy will be determined by using double blind spike samples for inorganics (i.e., ammonia, nitrate, TOC, caffeine). Spike samples will be diluted per Regional Board laboratory instructions. Samples marked QA/QC will be submitted to the laboratory to evaluate any matrix effects. The samples will be analyzed, spiked, and reanalyzed. The percent recovery for QA/QC samples will be calculated and used to assess matrix interference. Double blind spike samples and matrix spike samples will be submitted quarterly. The following equation will be used when a reference material is used:

$$\%R = 100 * \left(\frac{C_M}{C_{RM}}\right)$$

$\%R$ = Percent recovery
C_M = Measured concentration of reference material (RM)
C_{RM} = Actual concentration of reference material (RM)

3.4.3 % COMPLETENESS

Percent completeness is defined as a measure of how many collected samples actually yield valid and useable data. A minimum of 95% completeness is expected for this project. This will result in a sufficient amount of data to meet analysis needs. The following equation will be used:

$$\%C = 100 * \left(\frac{V}{T}\right)$$

$\%C$ = Percent completeness
V = Total number of measurements or laboratory results judged valid
T = Total number of measurements or laboratory results

3.4.4 REPRESENTATIVENESS

Representativeness is defined as a measure of how accurately a sample characterizes site conditions. Representativeness will be assured by using a statistically significant number of samples, and sampling at specific locations where a representative sample can be obtained. For example, a location where a representative sample can be obtained is a site where flows are well-mixed and at least 100 feet downstream from bias influences. Conversely, a location where a representative sample can not be obtained is a site that consists of a backwater pool.

3.5 SELECTED SAMPLING STATIONS

Regional Board staff conducted field reconnaissance in the Coachella Valley Storm Water Channel area on June 20, 2002 to ascertain general characteristics of surface waters (e.g., flow, channel width), and to identify potential sampling stations. Subsequently, potential sampling stations were chosen to: (a) get a broad characterization of drains discharging directly into the respective drain or channel, and (b) determine potential pathogen influences from agricultural, residential, and recreational areas. Sampling stations were selected based on location of domestic

waste treatment and disposal facilities (e.g., septic tank leachfields and wastewater treatment plants), previous sampling results, water flow direction, inflows, site accessibility, and best professional judgment. Sampling station locations may be revised based on Regional Board staff's best professional judgment. Revisions will be approved by the Project Manager, prior to implementation, and will be documented in the Project Files.

3.6 SAMPLING POINTS WITHIN A SAMPLING STATION

A typical sampling station (with the exception of narrow drains and samples collected for pathogen-indicator organism analyses) will consist of three sampling points (S1, S2, S3) distributed along the surface and perpendicular to the flow of the channel/drain (Figure 1). Sampling points will be spaced at approximately equal intervals from each other and from the channel/drain edges (i.e., at a distance equal to w/4, where "w" is the surface width of the channel/drain cross-sectional area). Equivalent volumes from each channel/drain cross-section will be combined to obtain a representative composite sample. For narrow drains, and for collection of pathogen-indicator organisms (i.e., fecal coliform, *E. coli*, fecal streptococci, and fecal enterococci), only one sampling point (i.e., S2) will be used.

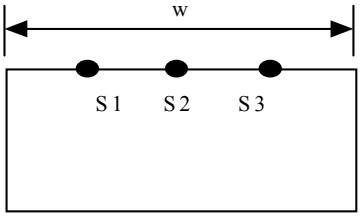

Figure 1: Sampling Points Within a Sampling Station

4 FIELD DATA ACQUISITION

Field data will be acquired by uniformly following sampling and handling protocols during all sampling events. Preservation methods and holding times will be adhered to strictly for all constituent samples, as prescribed by USEPA and 40 CFR 136. Additionally, a minimum two-day notice will be given to the laboratory prior to sample delivery, and samples will remain in Regional Board staff custody until relinquished to laboratory personnel.

Previously collected data (e.g., from County or Regional Board studies) may be used after checking its quality. The following factors will be taken into consideration: representativeness of similar conditions and documented bias.

4.1 INSTRUMENT CALIBRATION

The YSI 6600 multiprobe sonde will be calibrated in the laboratory prior to each sampling event pursuant to manufacturer instructions (YSI 1999). The sonde also will be tested in the field with known pH and EC concentrations, and re-calibrated as necessary **and** at the beginning of each day, when the monthly sampling activity takes more than one day to complete. The dissolved oxygen probe will be tested using tap water. Results of calibration measurements will be documented in the Field Log Notebook. Table 4 shows YSI parameter specifications.

Table 3: Parameter Specifications for the YSI 6600 Multiprobe Sonde

Parameter	Operating Range	Accuracy	Resolution	Calibration Standard
pH	0 to 14 units	± 0.2 units	0.01 units	3-pt, with pH buffered solutions (pH 4, 7, & 10)
Temperature	– 5 to 45 °C	± 0.15 °C	0.01 °C	not required*
Dissolved Oxygen (DO)	0 to 500% air saturation	0-200% air saturation: ± 2% of reading or 2% of air saturation (whichever is greater) 200-500% air saturation: ± 6% of reading	0.1% air saturation	Saturated air
Electrical Conductivity (EC)	0 to 100 mS/cm	± 0.5% + 0.001 mS/cm	0.001 mS/cm	KCl

* Per manufacturer specifications. Temperature accuracy will be verified every 6 months with a thermometer calibrated to standards of the National Institute of Standards and Technology.

4.2 SAMPLING AND HANDLING METHODS FOR CONSTITUENTS

Water samples will be collected at each sampling station, for the following constituents: pathogen-indicators (i.e., fecal coliform, *E. coli*, fecal streptococci, and fecal enterococci), ammonia, nitrate, TOC, and caffeine. To ensure accurate results, acceptance requirements for all sample containers are as follows:

- Pathogen-indicators, TOC, and caffeine sample containers will be sterilized and pre-preserved.
- Ammonia and nitrate sample containers will be certified clean and pre-preserved.

A label with a unique sample identification code will be affixed to each sample container, following manufacturer specifications. Unique sample identification codes will follow this format:

Project – Sampling Station – Sample Type – Sample Constituent

where: "Project" refers Coachella Valley Storm Water Channel (CVSWC);
"Sampling Station" refers to the name of the station;
"Sample Type" refers to a regular sample (2.0), blank sample (2.1), spike sample (2.2), matrix spike sample (2.3), or duplicate sample (2.4);
"Sample Constituent" refers to fecal coliform (FC), *E. coli* (EC), fecal streptococci (FS), fecal enterococci (FE), ammonia (A), nitrate (N), total organic carbon (TOC), or caffeine (C).

Sampling devices (e.g., auxiliary containers such as buckets) used for sample collection for lab analyses will be rinsed three times with native water prior to collection of samples at each sampling station. Do not rinse the sterilized and preserved bottles. Two grab samples will be collected at S2 (mid-channel) using one of the 100-ml sterilized containers described in Table 4, below, for each grab sample. One of the samples will be analyzed for fecal coliform and *E. coli.* The other sample will be analyzed for fecal streptococci and fecal enterococci. Each sample container will have 2.5 cm of headspace, contain the required preservatives, and be capped immediately after the sample is collected. The sample container will then be placed into an ice chest to maintain a temperature below 4°C until relinquished to the laboratory within holding time constraints (Table 4).

Water samples for ammonia, nitrate, TOC, and caffeine will be separated using a splitter (taking care not to introduce oxygen) that will distribute the water samples into the following containers: a 470-mL bottle for ammonia, 470-mL bottle for nitrate, 100-mL bottle for TOC, and 250-mL bottle for caffeine. Sample containers will contain the required preservatives, will be capped immediately, and will be placed into ice chests to maintain a temperature below 4°C until relinquished to the laboratory within holding time constraints (Table 4).

All water samples, from land or from boat, will be collected using a grab sample technique. Pathogen-indicator sample collection will involve field personnel plunging a 1000-mL, polyethylene, pre-cleaned bottle downward to approximately one-foot below the water surface with a gloved hand and allowed to fill. The bottle opening will be pointed upstream. The sample bottle will be capped immediately with 2.5 cm of headspace. Collection of all other sample constituents will involve the same procedure applied at all channel cross section sampling stations (S1, S2, S3) with the addition of splitting the samples in a churn splitter in order to obtain a composite sample.

When necessary to reach a sampling station, the bottle will be attached to the end of a "Swing Sampler®" (a long pole device). Field personnel will hold the Swing Sampler standing downstream of the bottle. The bottle then will be plunged downward to approximately one-foot below water surface, and allowed to fill with the opening pointed upstream. When a boat is used, water samples will be collected from upstream of the boat. Dirty equipment will be kept in the bow of the boat separated from clean equipment (e.g., ice chests) in the stern of the boat.

Table 4: Preservation Methods and Holding Times for Constituent Samples

Constituent	Container	Preservation Technique	Holding Time
Fecal Coliform	100-mL plastic	Cool below 4 ^{o}C; Sodium Thiosulfate Preservative (to neutralize any chlorine present)	6 hours
E. coli	100-mL plastic	Cool below 4 ^{o}C; Sodium Thiosulfate Preservative (to neutralize any chlorine present)	6 hours
Fecal Streptococci	100-mL plastic	Cool below 4 ^{o}C; Sodium Thiosulfate Preservative (to neutralize any chlorine present)	6 hours
Fecal Enterococci	100-mL plastic	Cool below 4 ^{o}C; Sodium Thiosulfate Preservative (to neutralize any chlorine present)	6 hours
Ammonia	470-mL plastic	Cool below 4 ^{o}C; Sulfuric Acid Preservative (pH<2)	28 days
Nitrate	470-mL plastic	Cool below 4 ^{o}C	2 days
Total Organic Carbon (TOC)	100-mL glass	Cool below 4 ^{o}C	28 days
Caffeine	250-mL plastic	Cool below 4 ^{o}C	21 days

Contaminated equipment will be packed in designated containers for transport to the Regional Board office. Field samplers will be responsible for cleaning and decontaminating all items exposed in the field. Appendix F discusses decontamination procedures in detail.

4.3 SAMPLING METHODS FOR FIELD MEASUREMENTS

Data will be recorded at each sampling station using a YSI 6600 multiprobe sonde, for the following field measurements (physical parameters): temperature, pH, DO, and EC. The sonde will be deployed at about one-foot below water surface. Readings will be taken within two feet of the center sampling point (S2) of the sampling station, immediately after the constituent samples are collected. Sample ID numbers, probe readings, field observations, and any deviations from the QAPP will be recorded in the Field Log Notebook immediately following collection of each sample.

4.4 CHAIN-OF-CUSTODY FORMS

All samples will be delivered with chain-of-custody forms. A sample chain-of-custody form is included in Appendix C. Any violation of holding times or other sample handling and custody requirements will be reported to the Project Manager and QA Officer, and recorded. This information will be taken into consideration during data validation.

5 LABORATORY DATA ACQUISITION

Laboratory data will be acquired by uniformly following protocols for all samples.

5.1 LABORATORY ANALYSIS METHODS

Table 5 lists the Laboratory Analysis Methods for the samples collected for lab analyses. Appendix D contains standard operating procedures (SOPs) and quality control procedures.

Table 5: Laboratory Analysis Methods for Constituents

Constituent	Method	Reporting Limit	Maximum Relative Percent Difference (RPD)
Fecal Coliform	Standard Method 9221E[1]	2 MPN/100 mL	Not applicable
E. coli	Standard Method 9221F	2 MPN/100 mL	Not applicable
Fecal Streptococci	Standard Method 9230B	2 MPN/100 mL	Not applicable
Fecal Enterococci	Standard Method 9230B	2 MPN/100 mL	Not applicable
Ammonia	USEPA 350.1	0.1 mg/L	20
Nitrate	USEPA 300.0	0.2 mg/L	20
Total Organic Carbon	USEPA 415.1	0.8 mg/L	20
Caffeine	AOAC 17th Edition 979.11 HPLC	0.001 mg/L	20

[1] Procedure 1, EC Medium

5.2 QUALITY CONTROL SAMPLES

Quality control checks will be implemented through the evaluation of quality control (QC) samples submitted to the laboratory as double blind samples. These QC samples include duplicate samples, field blanks, spike samples, matrix spike samples, matrix spike duplicate samples, and temperature blanks (Table 6). QC samples will be labeled and handled using the same methods as for constituent samples. Different QC sample types will be used to evaluate the following:

- Duplicate samples will be used to evaluate the accuracy of laboratory results, by taking two identical samples at the same location. Analysis results should reveal the same value for both samples.
- Field blanks consisting of de-ionized water will be used to evaluate if equipment is contaminating the samples. Field blanks will be taken into the field, run through equipment, and submitted to the laboratory for analysis.
- Spike samples will be used to evaluate the accuracy of laboratory results. Spike samples will be purchased from an independent laboratory, and will contain a known concentration of a constituent. Spike samples will be submitted to the analysis laboratory to see if they obtain the correct result. Laboratory results must be within 20% of the value submitted by the independent laboratory.
- Matrix spike (MD) and matrix spike duplicate (MSD) samples will be used to evaluate matrix effects for inorganic (i.e., ammonia, nitrate, TOC, caffeine) constituents. The laboratory will analyze, spike (i.e., add

more of a constituent), reanalyze, and calculate a percent recovery value, which will be used to ascertain matrix effects.

- Temperature blanks (stored in each ice chest) will be used to verify that samples were maintained at the proper temperature.

Table 6: Requirements for Quality Control Samples

Sample Type	Number of Samples	Frequency
Duplicate*	10%	each sampling event
Field Blank	10%	each sampling event
Spike	10%	quarterly
Matrix Spike	10%	quarterly
Matrix Duplicate Spike	10%	quarterly
Temperature Blank	not applicable	each sampling event

* Fecal coliform and *E. coli* will be analyzed from the same duplicate sample. Fecal streptococci and fecal enterococci will be analyzed from the same duplicate sample.

6 STATISTICAL DATA ACQUISITION

Statistical data will be acquired by uniformly following statistical methods for all samples. The Project Manager will manage and analyze field and laboratory data, using Excel spreadsheet software or other suitable software. The Project Manager will enter data into the spreadsheet program within 15 days following receipt of data. The QA Officer will evaluate QC data within 15 days following receipt of data, and will enter this data into the spreadsheet program. All data entries will be re-checked to catch any typing errors.

Data will be checked for normality, to determine whether to use parametric or nonparametric statistics. If data are distributed normally, then parametric statistics (e.g., means, standard deviations) will be used. If data are not distributed normally, then other parametric statistics (e.g., log transformation) or nonparametric statistics (e.g., Rank Test) will be used. This analysis will help evaluate unexpected outcomes in laboratory results (e.g., a low DO reading may result in an extreme TSS value, and could be an indicator of unobserved dredging).

A tolerance limit of three standard deviations (99% confidence interval) will be used for parametric tests, as a means of identifying potential outliers. The QA Officer will make a final determination as to whether a suspected outlier should be excluded from Source analysis calculations. All facts regarding suspected outliers will be documented in the Project Manager's final report.

7 DATA VALIDATION

Full, formal, and independent data validation is not mandated for this project. However, all records will be available for independent evaluation should the need arise later. Data is considered legally defensible when obtained through procedures discussed in this QAPP.

The QA Officer will ensure that QA guidelines were followed, by performing:

(a) a Technical Systems Audit for each sampling event, after all laboratory results are received. Data will be validated if collected and analyzed in conformance to the QAPP. The review will take into account field notes, field datasheets, chain-of-custody forms, laboratory analysis forms, and calibration assessment (determines potential error in field measurements). Documentation of results will occur within 15 days, and will describe data reviewed, review criteria, and data usability.

(b) Performance Evaluations of laboratories, through the use of quality control samples, namely split samples and matrix spike samples.

(c) a final Audit of Data Quality, which takes into account all Technical Systems Audits, and includes verification of proper calibration of the YSI 6600 multiprobe sonde and the results of laboratory QC samples. Laboratory results will be validated for precision, accuracy, and completeness.

(d) a Data Quality Assessment, in which statistical tools determine whether data met all Data Quality Objectives, whether the total error in the data is tolerable, and whether significant departures from the QAPP reduce data set completeness (and thus reduce data set usability for drawing conclusions).

Significant departures from the QAPP will be noted in these reports, and resulting data will not be validated (and thus will be excluded from the data set). Unacceptable departures include, but are not limited to:

- cross-contamination
- lack of critical sample collection information
- violation of sample holding times and temperatures

Regional Board staff will discuss missing analysis data with the laboratory that submitted the data. All missing data will be designated with "NR" (meaning "Not Reported") in the database.

8 HEALTH AND SAFETY PLAN

8.1 HEALTH RISKS

Field samplers will be exposed to relatively mild health risks, including:

- Incidental and accidental contact with potentially unhealthy water
- Heat exhaustion during summer months
- Disease vectors (e.g., mosquitoes)
- Slipping and/or falling

8.2 PROTECTIVE MEASURES

Field samplers can reduce health risks substantially *during* sampling events by following these procedures:

(a) Wear appropriate field clothing (e.g., jeans, cotton shirts, hat) and footwear (e.g., rubber-sole shoes or boots).
(b) Use sunscreen and mosquito repellent.
(c) Wear Level D Personal Protective Equipment (PPE), including latex examination gloves (inner gloves) and nitrile gloves (outer gloves) when collecting/handling water samples.
(d) Avoid touching anything (e.g., pens, bottles, probes) that dirty gloves could have contaminated.
(e) Know local emergency facilities, and call 911 during an emergency. The nearest facility to the project site is:

John F. Kennedy Memorial Hospital
47-111 Monroe Street
Indio, CA 92201
Emergency Phone # (760) 347-6191

All field samplers have the authority to stop a sampling event when he/she determines that site conditions (e.g., weather) preclude safe sampling.

Field samplers can reduce health risks substantially *after* sampling events by following these decontamination procedures in order:

1. Wash nitrile gloves (outer gloves) with antibacterial soap.
2. Remove latex examination gloves (inner gloves) carefully to avoid contact with bare skin, then discard them in a trash bag.
3. Wash hands thoroughly with antibacterial soap.
4. Dispose of wash water properly.

In the event of an accident, sampling activities will be discontinued until appropriate medical attention can be administered to any injured personnel. Seek medical attention via 911 paramedics or a hospital emergency room. Minor injuries may be cared for with the first aid kit. The Field Lead is responsible in the field for assessing the health and safety situation to determine if and when sampling activities will continue.

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